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Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
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CAS- A Turboprop Solution for the COIN Fight

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AUTHOR:
Roberto C. Scott, Major, USMC

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Mentor and Oral Defense Committee Member:
Mark Jacobsen
Approved: Mark Jacobsen
Date: 14 April 2009

Mentor and Oral Defense Committee Member:
Bradford A Wineman
Approved:
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Executive Summary

The Counter Insurgency (COIN) fight and asymmetric warfare in general, have become the new norm in modern warfare. As the U.S. military adapts to this ever-evolving fight, a shortfall has developed in Close Air Support (CAS) delivery. Modern U.S. fighters bring a terrific punch to the battlefield, but their limited on-station time and high attack velocities make them a poor fit for complex CAS delivery in the COIN fight. Attack helicopters are formidable platforms, but their slow speeds make for long transit times to and from the fight. Fixed wing and rotary wing attack aircraft are very expensive machines to fly and maintain. Today's Forward Air Controller (FAC) is often under fire, on the move, or cannot see the target. Our Information Surveillance and Reconnaissance aircraft are over-worked and in high demand.

A possible solution is an off-the-shelf turboprop aircraft. There are several models available immediately that can solve many of these problems. Modern turboprop aircraft are fast; most of the models presented here are 300+ knot aircraft. They can deliver ordnance at survivable speeds that still allow for solid target acquisition. These aircraft are very affordable. The initial purchase prices are fractions of what a modern jet costs. Turboprops are much cheaper to operate than rotor wing or fixed wing aircraft. They are survivable. Many of these aircraft are built with the latest Aviation Survivability Equipment installed, or at least hardwired for the upgrade. Modern turboprops have incredible endurance; some of the models here can loiter for 5+ hours of on-station time. This allows the pilot to develop a high degree of situational awareness and to direct the airborne fight with precision. Most of the turboprops presented here are

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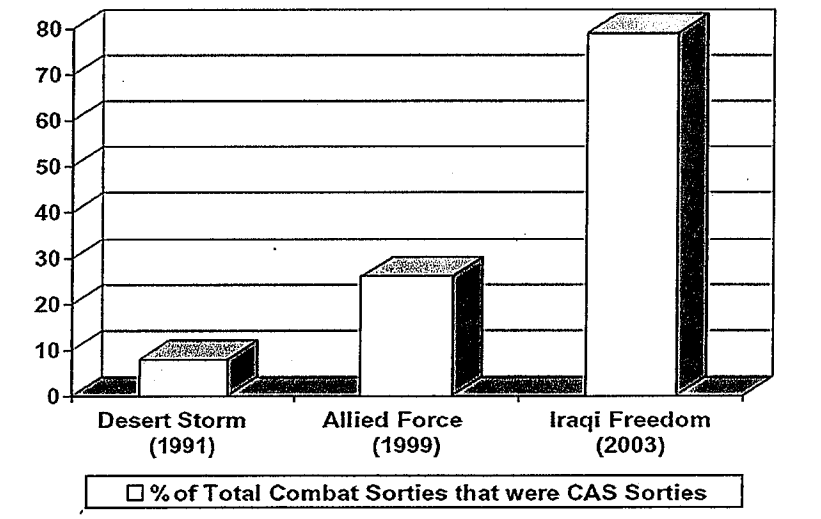
hardwired for off-the-shelf sensors, such as the third generation Brite Star from FLIR Systems.

The advantages offered by these turboprops are tremendous. It adds up to very capable aircraft that bridges the performance gap between rotor and fixed wing aircraft, and it does so economically.

The USMC has developed a CAS doctrine over the last several decades that is unequalled by any other service in any country. While some services view CAS as a secondary mission at best, USMC pilots train to support the infantry as THE mission from day one. From the early developmental stages of CAS techniques in WWII through the current Joint Tactics, Techniques, and Procedures for Close Air Support JP 3-09.3, the Marine Corps has been at the cutting edge of employment and development. The evolution of warfare over the last two decades has shown a greatly increased CAS sortie rate across all of the services.[1] The recent evolution of the COIN fight has only accelerated this increase. The increased prominence of the CAS mission has spurred greater efforts from the USMC to develop better tactics techniques, and procedures (TTPs) and a re-evaluation of CAS mission prominence by other services.



Source: Military Aviation: Issues and Options for Combating Terrorism and Counterinsurgency.

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This renewed emphasis on the CAS environment comes even as new challenges are developing for the FAC and the FAC(A) (Airborne) in the COIN environment. FACs, as talented as they are, often have a difficult time marking targets and getting a pilot's eyes on the target. This is through no fault of their own; often they are under fire or on the move and in difficult terrain. Modern Fixed Wing (FW) aircraft are incredibly fast and have a hard time acquiring targets in complex type I, II, and III environments even under the best of circumstances.[2] Of the many lessons identified from CAS engagements in OIF and OEF, identifying the target to the pilot proved to be one of the most difficult links in the kill chain.[3] There are tools that facilitate this talk-on, such as the Remotely Operated Video Enhanced Receiver (ROVER) system, but the required footprint is robust and the equipment is delicate.[4]

A possible solution to these issues is a return to a propeller driven aircraft. There are many off-the-shelf platforms that are a great fit for the CAS/FAC(A) mission that are geared toward the COIN fight. The USMC, and sister services, should take a hard look at them. Modern turboprop aircraft can fill the performance gap between jets and helicopters, can carry a formidable ordnance load, and have the endurance to remain on station for extended periods of time.

There are several off the shelf aircraft in production that are capable of a wide array of weaponry tailored to the COIN/lower-threat fight. The legendary Douglas A-1 Skyraider is a great model to emulate. Originally designed for service in WWII as an attack aircraft, the Skyraider arrived too late to for the conflict.[5] However, the A-1 saw service for over twenty years, and flew combat missions in both Korea and Viet-Nam. The Skyraider was carrier-capable and boasted a top speed of over 300 knots. The

Skyraider could carry thousands of pounds of ordnance and, in certain configurations, could loiter for nine hours of flight time. The Skyraider's drawbacks were the lack of an ejection seat and an outdated powerplant and avionics system. Since then, the USMC, and the rest of the US military, has adopted jets for this role under the premise that faster is better. Modern COIN experience has shown that this line of thinking might not always hold true. Michael Fabey in his article "Counter-Insurgency Urgency," wrote

> "The Air Force historically has modified high-tech jet fighters or bombers for COIN operations instead of investing in a counter-insurgency fleet, which would consist of ...lower, slower flying turboprop aircraft for fixed-wing needs. Jets can be used for limited COIN work, while it would be difficult if not impossible to do the reverse."[6]

The inability for the slower turboprops to conduct the entire mission set, from air to air and air to ground, has led to zero funding dollars for a dedicated COIN aircraft and to the adapting of jets to the COIN fight. Department of Defense logic has been to fund multi-role aircraft. "Speed is life" is a sound tenet beaten into the heads of fighter pilots everywhere and it certainly holds true in the Air Combat Maneuvering (ACM) realm. Unfortunately, the development of ever faster aircraft has led to poor performance and efficiency at lower airspeeds. In the COIN/Low threat environment a slower attack speed means greater pilot situational awareness and greater accuracy without necessarily increasing risk. A turboprop aircraft can fill this performance niche. Christopher Bolkcom and Kenneth Katzman touched on requirements for a simple CAS platform in their *Congressional Research Service Report for Congress: Military Aviation: Issues and Options for Combating Terrorism and Counterinsurgency,* published in Jan 2005:

"Today's CAS platforms suggest that modern avionics and targeting capabilities are essential to effectively attacking small groups of moving targets, but modern advances in stealth, maneuverability, and speed may not be required or even attractive..."[7]

A highly capable turboprop aircraft can operate in today's technologically complex environment at literally fractions of the costs of the modern jet aircraft currently fielded and/or proposed. There are many aircraft that can step into the COIN fight that fit Bolkcom's and Katzman's suggestions.

Brazil Embraer EMB 314 Super Tucano

An excellent candidate is the Super Tucano. This powerful turboprop aircraft is produced by Empresa Brasileira de Aeronautica (Embraer) headquartered in Brazil. Embraer is the fifth largest manufacturer of aircraft in the world and has produced many aircraft tailored for both commercial and military applications.[8] The Super Tucano is currently in service as a military trainer in several countries and as an attack platform in others. The airplane was introduced in 2003.

Performance- Powered by the indomitable Pratt & Whitney PT-6A, the Tucano's performance is impressive. It is rated at +7G/-3.5G, has a maximum speed of 320kts, a service ceiling of 35,000 feet, and an advertised range of nearly 3000 miles. The hardened canopy can withstand a birdstrike up to 270kts. The two-seat version has an advertised endurance of over four hours with a standard weapon loadout. A single seat version offers an additional 80

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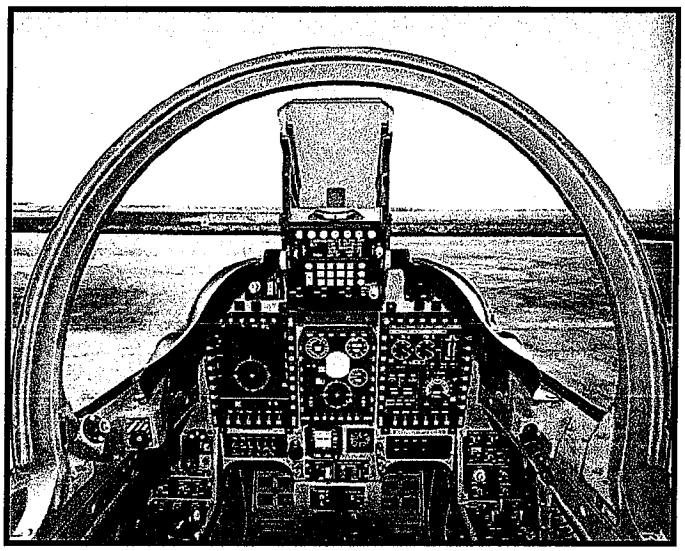
gallons of fuel, pushing the endurance to nearly 7 hours. Embraer advertises a service life of 18,000 hours for the training configuration and 12,000 hours for the operational configuration. The Tucano sports an On Board Oxygen Generating System (OBOGS), further reducing the maintenance footprint.

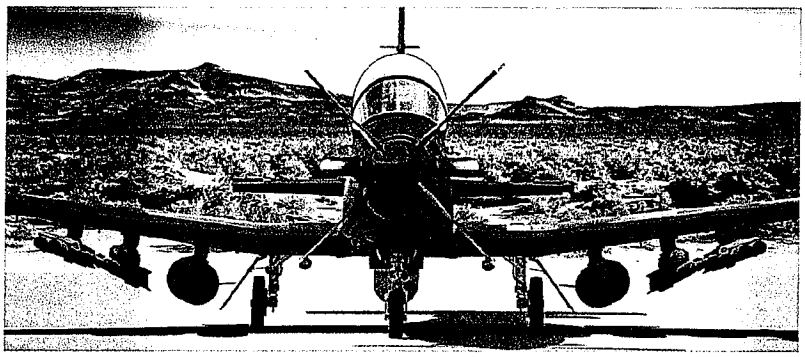
Avionics- The Tucano cockpit arguably rivals all but the F-22 in ergonomics, functionality, and upgradeability. Embraer has developed a fourth-generation HMI (Human Machine Interface) that is designed to ease pilot workload. Its all glass cockpit is a blend of form and function. The cockpit features HOTAS (Hands on throttle and stick) technology, laser INS/GPS Navigation, a Heads Up Display, Color Multi-Function Displays, integrated Comm/Nav suite, provisions for data link interface, FLIR, and a Night Vision Device compatible cockpit.



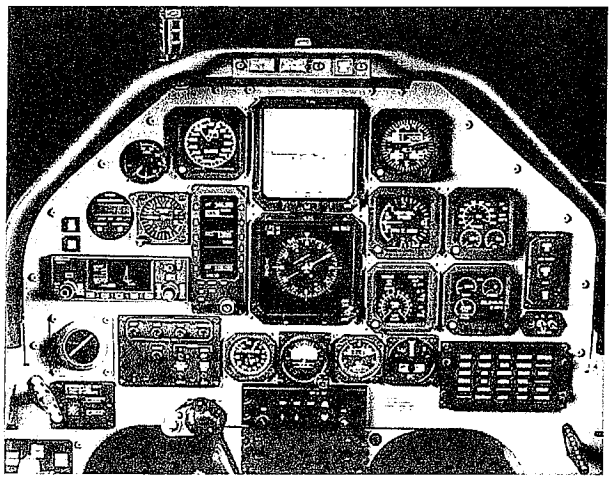
Armament/Survivability- The Super Tucano can field an impressive array of weaponry. Two .50-caliber machine guns are embedded in the wings, and the airframe sports five hard points that can be fitted with a variety of ordnance. A wide range of survivability equipment is incorporated. The airframe has armor protection, chaff and flare capability, a Missile Warning System, and a Radar Warning Receiver system. If all else fails, the Super Tucano is equipped with Martin-Baker MK-10LCX ejection seats.[9]

Hawker Beechcraft AT-6 Texan II

Another proven candidate is the Texan II. As the current trainer for Air Force and Navy primary flight schools, the Texan II has a strong foothold in the US military and will soon be the "first love" of hundreds of newly minted Naval and Air Force aviators.



Performance- The Texan is also powered by the Pratt & Whitney PT-6 engine, and the airframe is rated for +7G/-3.5Gs, with a top speed of 316kts. Her service ceiling is 31,000 feet with a range of 1491 miles. The cockpit is well designed, all glass, and tailorable to consumer specifications. The plane has an expected training life of approximately 16,000 hours.



Avionics- The Texan also has an partial glass cockpit that is highly functional and upgradeable. The cockpit features GPS Navigation, provisions for a Heads Up Display, six Color Multi-Function Displays, and an integrated Comm/Nav suite. Hawker Beech also reports that more advanced avionics, a datalink system, and a FLIR system and Aircraft Survivability Equipment are all systems easily incorporated into the airframe.

Armament/Survivability- Although the T-6 only flies as a trainer in the U.S., the Hellenic Air Force flies the T-6A as a primary and advanced trainer. The first 25 ordered are straight leg trainers, but the follow on aircraft will have six hardpoints exposed for

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training in ordnance delivery.[10] Hawker Beechcraft has implemented six hard point structures in all Texan configurations, but the training versions do not have exposed hardpoints outside the skin of the wing. Additionally, the Texan has Martin-Baker Mk16LA for ejection requirements.

Augusta/Bell 609

The escort challenges presented by the versatile MV-22 Osprey have led to calls for a gunship variant. Of the proposals presented here, this concept is the most radical, the most expensive, and certainly is not "low tech." However, the potential benefits of a tiltrotor gunship make the concept worth mentioning. During the development of tiltrotor technology, Bell produced several smaller designs, as they worked up to the MV-22. Sensing a strong civilian market, Bell partnered with the Italian helicopter manufacture Agusta to fully develop tiltrotor technology for business applications. Although the Bell 609 is a long way from a military gunship, the advantages of the development are obvious when presented as a partner to the Osprey. Bell boasts the 609 can cruise at 275kts, at a pressurized 25,000ft, and at a range of 1000nm.[11] Before the US military can give it serious consideration, several major obstacles must be tackled. First, the Bell 609 is a side-by-side seat configuration. A tandem seat configuration is a better design as it offers a much greater visibility in the objective area. Second, the large protors on tiltrotor aircraft present a unique weapons delivery challenge. The strength of helicopter gunships is their ability to deliver off-axis fires—a strength any successful tiltrotor gunship would have to duplicate. The range of movement presented by the tilting engines and the broad protor arc creates a challenging weapons traverse problem.[12] Finally, tiltrotor technology is very expensive. This base cost does not take into account

the weaponization of the model. This process would undoubtedly make the machine much more expensive.

Arguments Against

Fighting the Last War?

The platforms explored here are slower platforms that will perform well in the medium to low threat environment. Many will say that a program creation for this niche is "fighting the last war," in reference to the low threat "unconventional" environments present in Iraq and Afghanistan after 2003. However, a look at post-WWII conflict shows that the majority of worldwide conflicts have been unconventional. Even today the National Defense Strategy of June 2008 warns citizens about the ongoing threat of violent extremist movements, and states "Combating these violent groups will require long-term, innovative approaches."[13] Further, the Quadrennial Defense Review of Feb 2006 lists two fundamental imperatives for the Department of Defense. The first one states, "Continuing to reorient the Department's capabilities and forces to be more agile in this time of war, to prepare for wider asymmetric challenges and to hedge against uncertainty over the next 20 years."[14] Clearly, the U.S. leadership and the Department of Defense believe that the U.S. will be engaged with an asymmetric threat for the foreseeable future. Iraq and Afghanistan have taught (or re-taught) the US military the intricacies of the COIN fight. Unfortunately, potential U.S. enemies have been watching and learning, all over the world. The insurgent leadership are developing tactics, techniques, and procedures to counter U.S. strengths, most notably U.S. reliance on air power.[15] The United States has demonstrated in operations such as Desert Storm, Enduring Freedom, and Iraqi Freedom that standing against U.S. forces in open battle is

virtual suicide. From an insurgent point of view, a neat, conventional fight is unaffordable and untenable. A long insurgency is a proven model for success, and history has shown that an insurgent only needs to survive to win.

Survivability

There are noteworthy arguments against a turboprop platform tailor made for the COIN fight. The first and most legitimate is survivability. The A-1 Skyraider's service in Viet Nam gives us a unique opportunity to look at a propeller driven airplane operating side-by-side with jet aircraft in a complex threat environment.

In 1976 the Office of Naval Research studied aircraft losses over Viet Nam from January of 1962 through June of 1973. The research offers an interesting data set, and offer a rare glimpse of the two propulsion systems operating side by side in both the high threat of the North and the lower threat of the South. One of the most telling data points is the loss of aircraft over South Viet Nam (SVN) vs. loss of aircraft over North Viet Nam (NVN). Over the high-threat, enemy-held territory of NVN, 54 Skyraiders were lost. During the same period over SVN, 49 Skyraiders were lost.[16] Although this seems an almost acceptable ratio considering the higher threat of NVN, the comparison does not take into account that 12071 more sorties were flown in SVN during the same timeframe.[17] The greater number of sorties flown in SVN did not produce a proportional increase in losses. A better picture develops when looking at combat losses per 1000 sorties. Over NVN the Skyraider lost 2.5 aircraft per 1000 sorties. Over SVN, this ratio fell to 1.1. Of note, the mission set in NVN was different than SVN. The NVN missions were primarily Deep Air Support (DAS). The SVN missions were much more varied, but included both DAS and CAS. Not surprisingly the higher threat presented by the North

produced twice as many losses as the lower threat South. This offers a sound argument for propeller driven aircraft operating primarily in low-threat environments.

Perhaps even more interesting is a comparison of the A-1 vs. some of the newer jet powered attack aircraft of the Viet-Nam era. The two types of aircraft operated side by side in both the high threat of the North and the lower threat of the South. As mentioned above, the Skyraider lost 2.5 aircraft per 1000 sorties over NVN and 1.1 aircraft per 1000 sorties over SVN. During the same timeframe, the A-7 loss ratio was 1.5 and 0.2 respectively. The F-105 was 3.3 and 0.3. The A-4 was 1.7 and 0.3. Thus, the Skyraider did have a slightly higher loss ratio when compared to the faster, more modern aircraft. However, the Skyraider was developed during WWII, fully a decade prior to the A-4, A-7, and F-104, and it did not enjoy much of the modern survivability equipment, system redundancies, and technologies that were available on the newer aircraft.

Finally, the argument that speed and maneuverability are paramount to survival loses some momentum considering that AH-1s, UH-1s, and AH-64s are effectively fighting and surviving in the same environment as their fixed-wing cousins and doing it between 100-150kts. The turboprop airplanes explored here will have a much larger operating envelope than their helicopter counterparts. Turboprop aircraft are able to quickly transit to the battlefield at 275 kts, loiter overhead to develop their situational awareness, and then increase their airspeeds to satisfy attack profiles.

Clout

The propeller driven examples presented here will not have the ordnance payload of an F/A-18 or a JSF-35. However, the dwell time for tanker visits combined with the

lengthy time required to develop (or re-develop) a pilot's situation awareness to an objective area offsets the impressive payload. Many high performance aircraft have returned to base with ordnance because they were unable to acquire the target. The average payload for turboprop aircraft presented here are between 2000 and 3000 lbs as they exist today.[18] With the precision accuracy of today's weaponry, this is a very respectable payload. The Embraer and Texan offer five and six hard points respectively, making both aircraft highly adaptable to a variety of ordnance loads and missions.

Operating Environment

Unfortunately, the Embraer and the Texan are not capable of launching from US Navy shipping. The Bell-609 tilt-rotor theoretically can operate from amphibious shipping, as her larger cousin has successfully conducted shipborne operations. This significantly limits the scope of the turboprops to a secure airfield. However, with the Long War established as the new paradigm, this does not seem to be much of a detractor.

Pro Arguments

Cost

A modern Fighter/Attack platform costs many tens of millions of dollars. The JSF cost $2.2 billion just for the Concept Demonstration Phase competition between Boeing and Lockheed Martin. This is not counting the additional contract to Pratt and Whitney to develop an engine. This was for an advertised cost per unit of $28 million. At the writing of this article, the cost was approaching $50 million/copy due to an Air Force reduction in number of aircraft ordered.[19] These staggering costs appear much more grotesque when contrasted against the off-the-shelf turboprops. The Embraer Super Tecano is the bargain basement airplane coming in at a cost of $1.9 million per copy. As

the best performer of the aircraft mentioned here, the Embraer is easily the most capable airframe. The Hawker Beechcraft, in its current configuration as a trainer, comes in at 6 million per copy.[20] The Bell-609 civilian application has a price tag of between $6 and $10 million per copy.[21] The Texan II and the Bell-609 would have significant cost increases to weaponize both platforms. Development and purchasing costs aren't the only savings realized by a COIN dedicated aircraft. Operating costs are substantially reduced as well. Major Brett Blake, USAF, did an outstanding Maintenance Man Hours per Flying Hour (MMH/FH) comparison in his "AT-6—The Best USAF Investment for the Long War" paper. The T-6 Texan II has an MMH/FH ratio of 2.02. The A-10 Warthog has a ratio of 14.03, the F-15E has a ratio of 22.75, and the F-16C has a ratio of 17.75.[22] Clearly the turboprop aircraft is cheaper and easier to operate by orders of magnitude.

Information, Surveillance, and Reconnaissance

The cost effective turboprops bring another benefit to the modern battlefield: another very capable Information, Surveillance, and Reconnaissance (ISR) platform. At a time when battlefield commanders cannot get enough ISR support, each one of our proposed turboprops would come with an impressive array of sensors, ready to tie into modern network-centric battlefields. In fact, in an effort to ease the ISR demand in U.S. combat theatres, the Air Force is configuring a fleet of 37 C-12 Huron Turboprop aircraft as ISR platforms.[23] Among the arguments for fielding the C-12s cited by USAF BGen Blair E. Hansen was their "...low footprint when it comes to ramp space on a flightline, but also they're easy to maintain and operate." So, despite Air Force resistance to low-tech solutions, it appears they are already moving that direction out of necessity.

Although the turboprop CAS platforms do not have the endurance of many of the UAVs currently fielded, they offset this shortcoming by having a pilot on-scene with a highly developed situational awareness, ordnance onboard, and the ability to direct the fight. Further, the turboprops will have longer endurance than any of the manned CAS platforms currently fielded.

Simplicity and Durability

The Super Tecano and the Texan II are powered by variants of the mighty PT-6 engine, built by Pratt and Whitney. It is the most prolific turboprop engine in history; it is used in over 65 current applications and over 36,000 units have been produced flying a staggering 300 million flying hours.[24] The US military is very familiar with the powerplant, as it has several aircraft that currently use various models. Suffice it to say, that the PT-6 engine is proven and dependable, and it comes with a well-established supply line. The avionics packages offered for the Super-Tecano and Texan II are off-the-shelf proven technology. This requires no research and development money or time, and virtually guarantees interoperability with current fleet aircraft and currently fielded FAC equipment.

Endurance

Endurance is always a problem for modern day attack aircraft. F/A-18's, AV-8B's, and the future JSF consume fuel at a rapid rate, and depend on the closest tanker track for extended operations. Maintaining a preplanned (on call or scheduled) overhead watch on an unfolding battlefield requires a complex mix of strip alert, tanker support, aircraft sections moving in and out of the battle space for the tanker track, and airspace deconfliction measures to control the high volume of traffic. As each section of aircraft

checks back in after a tanker plug, the ground situation changes, requiring a timely update to the friendly and enemy situation. The need to receive this update and to assimilate it burns into precious on-station time.

V-22 Escort

Finally, the MV-22 is proving itself to be a worthy addition to the USMC fleet of aircraft. Several Iraq combat tours have let to the gradual expansion of its combat envelope. However, this unique aircraft is too fast for helicopter escort and too slow for high performance jet aircraft escort. There are "work-arounds" to escort the tiltrotor MV-22, but they are all less than optimal. Here is another opportunity for a turboprop.

Conclusions

This paper is not an indictment of the fixed wing or the rotary wing communities. Pilots in these communities do an outstanding job every day protecting Marines and soldiers on the ground. This proposal is a call to exploit a gap in the attack environment; a modern warfare niche that can be filled adequately and inexpensively with a turboprop aircraft. Accepted logic dictates that a faster aircraft is more survivable and it is true to a certain extent; here it is argued that a slower aircraft offsets the velocity advantage with pilot situational awareness, cost, and loiter time. As the long time leader in CAS innovation, the USMC is the recognized authority in delivering close fires. In the Long War COIN fight Marines should not hesitate to suggest a cost effective solution if it will improve service to the Marine on the ground—even if that suggestion goes against accepted logic. A turboprop aircraft is survivable, it has significant endurance, it carries a formidable payload, and using existing technology, can be cheaply purchased and maintained. The warriors of the Long War deserve nothing less.

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[1] Bolkcom and Katzman, *Military Aviation: Issues and Options of Combating Terrorism and Counterinsurgency*, CRS report for Congress RL32737 (Washington, DC: Congressional Research Service 24 Jan 2005), 18.

[2] U.S. Department of Defense, Joint Publication 3-09.3 *Joint Tactics, Techniques, and Procedures for Close Air Support (CAS)* (Washington DC, 03 Sept 2003) V-14-15.
Type 1 control is utilized when the risk assessment requires them to visually acquire the attacking aircraft and the target under attack.
Type 2 control will be used when the JTAC desires control of individual attacks but assesses that either visual acquisition of the attacking aircraft or target at weapons release is not possible or when attacking aircraft are not in a position to acquire the mark/target prior to weapons release/ launch.
Type 3 control may be used when the tactical risk assessment indicates that CAS attack imposes low risk of fratricide.

[3] USMC Lessons Learned Center. *Urban Close Air Support (Urban CAS) A summary of collected lessons, observations, interviews, after action reports and relevant documents from OEF, OIF I, and OIF II* (Quantico, VA, Marine Corps Lessons Learned Center, 2005), 6-8, https://acc.dau.mil/CommunityBrowser.aspx?id=23451.

[4] A ROVER (Remote Operations Video Enhanced Receiver) feed is a real time video downlink capability shared by many attack aircraft and UAVs. It provides a video feed of what the pilot viewing on his sensors transmitted down to the FAC. It dramatically increases the situational awareness of both pilot and FAC. It requires additional equipment on some airframes, and obviously requires the use of monitoring equipment on the ground.

[5] Gordon Swanborough and Peter M. Bowers, United States Navy Aircraft Since 1911 (London: Putnam, Second edition 1976), 176.

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[13] U.S. Department of Defense. *National Defense Strategy* (Arlington, VA. Department of Defense, June 2008) 2.

[14] U.S. Department of Defense. *Quadrennial Defense Review Report* (Arlington, VA. Department of Defense, Feb 2006) 1.

[15] Al Qaeda SOP dictates an after action report after each operation so that "...strengths and weaknesses of the attack...can be gauged and the effectiveness of future operations be improved." Rohan Gunaratna, *Inside Al Qaeda, Global Network of Terror* (New York, NY. Columbia University Press, 2002) 75.

[16] Center for Naval Analyses, *U.S. Navy, Marine Corps, and Air Force Fixed Wing Aircraft Losses and Damage in Southeast Asia (1962-1973) (U)* (Arlington, VA, Center for Naval Analyses, 1976) 1-2-1-3.

[17] Center for Naval Analyses, *U.S. Navy, Marine Corps, and Air Force Fixed Wing Aircraft Losses and Damage in Southeast Asia (1962-1973) (U)* (Arlington, VA, Center for Naval Analyses, 1976) 1-4.

[18] This is an estimate. The actual ordnance load is widely variable dependent upon airframe, configuration, fuel load, etc.

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